DOCUMENT RESUME

ED 284 748 SE 048 293

AUTHOR Foster, Gerald Wm., Ed.
TITLE Abstracts of Presented Papers and the Proceedings of the Association for Education of Teachers in Science--North Central Region and Society for College Science Teachers Conference (Indianapolis, Indiana, October 29-30, 1986).
INSTITUTION Association for Education in Science in North Central Region.; Society for College Science Teachers.
PUB DATE Apr 87
NOTE 34p.
PUB TYPE Reports - Descriptive (141) -- Collected Works - Conference Proceedings (021)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Cognitive Style; *College School Cooperation; *College Science; *Elementary School Science; Elementary Secondary Education; Higher Education; School Community Relationship; Science and Society; Science Curriculum; *Science Education; *Science Instruction; Science Teaching Centers; *Secondary School Science; Teacher Education
IDENTIFIERS *Association for Education of Teachers in Science

ABSTRACT

This document contains the abstracts of the presentations made at this conference. Topics of presentations included: (1) linking research and science teaching using community resources; (2) planning science teacher workshops; (3) school-related recycling programs; (4) improving student attitudes toward science; (5) rural science teaching; (6) spatial versus conceptual reasoning in geology; (7) critical thinking; (8) learning and thinking styles; (9) courses spanning science and education; (10) organizing centers for science education; (11) using video training to enhance teacher skills; (12) science literacy in high school and college curricula; (13) interdisciplinary teacher training; (14) school district collaboration with higher education; and (15) program evaluation. (TW)

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ABSTRACTS OF PRESENTED PAPERS AND THE PROCEEDINGS

NC-AETS/SCST 1986 CONFERENCE

Association for Education of Teachers in Science - North Central Region and Society for College Science Teachers in Cooperation with

DEPAUL UNIVERSITY

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Association for Education of Teachers
in Science - North Central Region
and
Society for College Science Teachers

The Atkinson Hotel
Indianapolis, IND.

October 29-30, 1986

DePaul University
Chicago, IL. 60614

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PREFACE

It has been several years since a North Central Regional Conference of the Association for the Education of Teachers in Science has taken place. These abstracts represent the contribution of all of those who made the 1986 conference a reality and to the revitilzation of the A.E.T.S. North Central Region which has become a contributor to the professional advancement of science education.

The conference was also a success because of invaluable contributions made by members of the Society for College Science Teachers. The collaboration between the two organizations at the conference gave new insights and perspectives about quality programs and ideas that have originated through the collaborations of educators and scientists at institutions of higher learning for the education of present and future science teachers. For these reasons, it is a pleasure to put this first volume into print as well as looking forward to the publication of future of North Central A.E.T.S. Conference Abstracts.

Gerald Wm. Foster
Editor

Director's Message

It was a pleasure to confer with Dr. Ron Bonnstetter, who served as Co-Director for the Association for the Education of Teachers in Science - North Central Region, and to have his support during the planning stages as well as during the 1986 Indianapolis Conference. It made the task much easier to bring the conference to fruition.

It is in my opinion that the main objective of the Conference, linking together college science teachers and science educators, was achieved through dialogues, discussions, and paper presentations. Not only was it achieved formally, but it was also achieved informally through mixers and chats between sessions.

The presentations ranged from statewide projects involving school districts retraining programs to model undergraduate science programs in community as well as small private colleges. It was evident that the presenters are committed to improving science teaching and the general image of the scientific profession.

We were not only fortunate to have quality papers, workshop, and panel groups from members within our region but also by colleagues representing other regions as well as the Society for College Science Teaching. Presenter came as far away as California and North Carolina in addition to representatives from the Southwest Region states such as Oklahoma and Kansas. Finally it was evident the objective was achieved because for some

colleagues, this was their first experience as a presenter and as participants in not only the Association for the Education of Science Teachers and the Society College Science Teachers, conference but also participation in the regional National Science Teacher Association Convention.

If you've participated in the 1986 Conference, a heartfelt "thank you" with the hope you will continue to be involved in future conferences. If you haven't enjoyed membership in our activities, we sure hope you'll look over the abstracts from the 1986 meeting and seriously consider joining us in the future.

October 1987 - Peoria, Illinois

Mark your calendars for October 14th and 15th, 1987. We expect to begin early evening on the October 14th and complete by the afternoon of October 15th. Peoria, Illinois has been selected as the location for the 1987 A.E.T.S. Conference which will precede the Illinois Science Teachers Convention. Our conference will again be a joint venture between Association for the Education of Science Teacher and the Society for College Science Teachers.

Plan your program submission now! What ideas do you have? Two ideas have surfaced for the conference theme:

1. What other kind of revision models might be considered for the training of science teachers? Much attention has been given to the Holmes and Carnegi Reports. Other alternative models need to be examined and explored.

2. What collaboration is ocurring between Community Colleges, four year Colleges, and local elementary and high schools science programs for the improvement of science teaching? Ideas could be shared at the conference.

Leon Zalewski has consented to help with this conference and to plan the 1988 conference.

NORTH CENTRAL AETS/SCST PROGRAM 1986
PROGAM SCHEDULE

NC - AETS/SCST REGIONAL PROGRAM

Indianapolis, IN 1986

(October 29, 1986) Wednesday:

4:00 - 7:00	Registration (dinner on your own)
7:00 - 9:00	Program
7:00 - 8:00	PAPER SESSION
7:00 - 7:20	SESSION #1:
	A.M. Sauro and K.M. Elsen: "A Link Between Research and Science Teaching Useing a Community Resource"
7:20 - 7:40	SESSION #2:
	P.S. Bowers: "Utilizing Multiple Resources in Planning Middle School Science Teacherr Workshops: A Model Program"
7:40 - 8:00	SESSION #3:
	P.J. Doyle: "Multiple Benefits of a School Related Recycling Program"
8:00 - 9:00	CONCURRENT PAPER SESSIONS

SESSION A LaPetit Palais	SESSION B Parlor B
C. Wareing: "Can We Improve Students' Atitudes Toward Science?"	C.R. Ault, Jr. "Spatial vs. Conceptual Reasoning in 'the first' Structural Geology Exercise"

(Con't)

SESSION A	SESSION B
LaPetit Palais	Parlor B
J.A. Tonnis: "A Campus-Wide Model for Science Education"	D.B. Pribor: "Critical Thinking in Science Courses"
L.G. Enoch: "The Rural Science Teacher: Findings from an Ethnographic Study"	L. Zalewski: "Learning and Thinking Styles in Science"

9:00 - 10:00 PANEL DISCUSSION (LaPetit Palais)

"Applications of Science: Courses Spanning Science and Education." J. Penick, R. Yager, V. Lunnetta, J. Krajcik, R. Bonnstetter

10:00 - ?:?? INFORMAL INTERFACING ("Social Seminar")

(October 30, 1986) Thursday:

8:00 - 10:00 Registration (breakfast on your own)

8:00 - 9:00 Session I (CONCURRENT WORKSHOP)

WORKSHOP A	WORKSHOP B
Mezzanine	Parlor B
R. Allen, D. Stroup: "Developing Critical Thinking Skills in Science Teaching	P.G. Smith: "An Approach to High Interest, Interest, Practical Science Literacy through the High School and College Curriculum"

10:00 - 10:15 BREAK

10:15 - 11:15 SESSION III (CONCURRENT PANELS)

PANEL A	PANEL B
G. Summers, J.E. Bauman, B. Burchett, S.R. Quinn, R. Henderson: "An Interdisciplinary Program of In-Service training for Junior High School Science Teachers in Missouri"	C. Wareing: "School District Collaborations with Higher Education"

11:15 - 12:15 SESSION IV (CONCURRENT PANELS)

PANEL A	PANEL B
C.L. Price, R.E. Lundgren R. Cupp, K. Forness, B. Schuessler: "What We Learned: Two Programs Linking College and Pre-College Science and Mathematics."	J. Penick, J. Krajcik, R. Bonnestetter: "Program Evaluation: Some Idea and Examples"

12:30 - 1:45 LUNCH - PARLOR C

Walter J. Bogan, Director Science Resources for Schools - American Association for the Advancement of Science

1:45 - 3:15 SESSION V WORKSHOP

W.J. Bogan "AAAS Science Resources for Schools"

3:15 - 3:30 BREAK

3:30 - 4:30 SESSION VI PANEL

R. Allen, Hans Andersen, D. McCurdy et al. "Implications of the Holmes Group to Science Education and Science Teaching"

4:30 - 5:00 Business Meeting: "The Future for the North Central AETS Regional Meetings"

A Link Between Research and Science Teaching Using a Community Resource

Angela Sauro
Kay Elsen

Mount Mary College
Milwaukee, Wisconsin

This model describes the link between research and teaching through two Mount Mary research projects that use the Milwaukee County Zoo as a resource. The two research projects are research experience and a faculty research project. The student research experience involved a group of undergraduate microbiology students who studied the normal and diseased aerobic bacterial floral of captive reptiles. This student research provides a successful working model for the balance between research and teaching that is necessary for the success of a modern undergraduate scientific education program.

The faculty research project aims at faculty development and the enhancement of teaching. This program has had led to the development of a zoo course for non-science major in which students are able to recognize parallels between their area of study and the zoo. Since the course participants come from a variety of disciplines, projects that connect these disciplines with the zoo were encouraged. Some of the projects developed into mini-internships which were supervised by zoo personnel.

Where possible, students combined the projects with related assignments in other courses. The students also became aware of the variety of carrers that are utilized by a zoo and how their field could fit into and be used as a valuable community resource.

Utilizing Multiple Resources in Planning Middle School Science Teachers Workshops: A Model Program

Patricia Bowers
University of North Carolina
Chapel Hill, North Carolina

OVERVIEW

Our workshop sessions consisted of four two-day and one one-day programs. They were designed to utilize community, school, university, and business resources to present content information in new areas, to provide opportunities to update in the traditional subject areas, and to provide hands-on materials and teaching ideas the teachers could use directly in the classroom.

The content areas selected were representative of the North Carolina integrated curriculum in the life, earth/space, and physical sciences for grades seven and eight. Other topics included computer software evaluation, scientific research in the Research Triangle Park (NC), and ways in which to implement the integrated science curriculum.

PURPOSE

In 1984 the State Board of Education in North Carolina reorganized the science curriculum for its public schools. One significant change was an integration of life, earth/space, and physical sciences in the seventh and eighth grades. For some twenty years prior to this the seventh grade offering was life science and earth science in the eighth grade.

While many science education specialists agree that an integrated approach is a good one inasmuch as there is considerable overlap among the subject areas, the implementation of the program presented difficulties for some teachers. Many of them had a background in only one subject area and had been teaching in one area only. Consequently, professional development usually was centered around their particular teaching area. There was a need for content-area updating, especially in those areas of the integrated curriculum in which they had not been teaching.

SUMMARY

This workshop was designed speceifically to help the middle school science teachers of North Carolina. It was also designed to be a model for other areas to utilize as they designed strategies to further their goals in the area of science education. More specifically, it was designed to provide teachers with content information and hands-on activities to enhance the quality of the teaching of science. The model is designed to be relatively inexpensive, utilizing the resources at hand in a particular area.

Multiple Benefits of a School Related Recycling Program

Patrick Doyle

Middle Tennessee State University
Mufreesboro, Tennessee

MULTIPLE BENEFITS OF A SCHOOL RELATED RECYCLING PROGRAM

The newspaper recycling program run by the Middle Tennessee State University Biology Club has proven to be a major source of good public relations for the biology department and the universtity. The $50,000 raised has been used to establish nine scholarships through the university's Foundation. In turn the scholarships have enabled us to attract top high school students, promote our graduate program, our summer field courses and recognize our top academic students. Community leaders see the program's value in reducing pressure on the county's solid waste landfill. The three million pounds of recycled newspaper have saved the county nearly $50,000 in disposal costs. In the classroom, the usefulness of the program as an example of the benefits of a conservation-recycling program should not be underestimated.

CAN WE IMPROVE STUDENTS' ATTITUDES TOWARD SCIENCE?

Carol Wareing
California State University
Long Beach, California

Relationships among students' attitudes toward science, as measured by the WASP, (Wareing Attitudes toward Science Protocol), stated antecendents of such attitudes, and class achievement or performance indicated by reported grades were investigated for a survey sample of 1,740 students in eighty-seven (87) high school science classes from five (5) communities.

The data were reviewed to determine the degree of relationship among the variables described. Additionally, students' self-reported science area preferences, academic engaged time in respective courses, number of tests administered in the given course, perceived rewards, degree of stress, and internal structure of the course have been examined as potential predictor variables.

Simple correlation and multiple regression correlation formulas have been applied to the data.

Results have been reported in terms of .05 and .01 levels of significance. The degree of statistical significance varies for each variable.

A CAMPUS-WIDE MODEL FOR SCIENCE EDUCATION

John Tonnis
University of Wisconsin-La Crosse
La Crosse, Wisconsin

Responding to the national concern about science education, the University of Wisconsin-La Crosse, in 1984 developed a campus-wide model which fosters cooperation between science faculty and education professionals. The Science Education Coordinating Committee with full intercollege cooperation, coordinates this University's credit and noncredit efforts in science education. This group was instrumental in the development of an ongoing summer science program for K-12 teachers. This summer program consists of a series of one to three week courses designed specifically for practicing teachers. Each course emphasizes science content material which has a direct application to the classroom and, in most instances, is not available in traditional science or education departments. All courses provide teachers with the necessary content background and methodology to incorporate the course material into existing school curricula.

The presentation will briefly discuss the development, structure, and function of the Science Education Coordinating Committee, including the use of this group to encourage the active participation of science faculty in both the prebaccalaureate and postbaccalaureate training of teachers. The paper will also briefly discuss the development, funding, administration, evaluation and future direction of the successful summer science program.

THE RURAL SCIENCE TEACHER: FINDINGS FROM AN ETHNOGRAPHIC STUDY

Larry Enochs
Kansas State University
Manhatten, Kansas

Last summer, 16 rural teachers participated in two weeks of training in science, science education and staff development. During this summer they planned and developed a curriculum change for their district. Each teacher was assisted in tailoring an improvement plan to meet the needs of their community and school district. During the following school year, an intensive ethnographic study was conducted to assess the implementation of the proposed curricular changes. This paper will provide selected case studies from the study.

SPATIAL VS. CONCEPTUAL REASONING IN THE "FIRST" STRUCTURAL GEOLOGY LAB

Charles R. Ault, Jr.
Indiana University
Bloomington, Indiana

Geologists consider "visualization" essential to problem solving skill. Structural Geology is a watershed course for the geology major, one in which failure to develop visualization skills can prove disastrous. There is little educational research about the difficulties had by students in their first structural geology course. This study was a preliminary effort to characterize how students in structural geology reason about problems presented in a first (or early) laboratory. Research focused on "thickness problems" -- determining the true thickness of a layer of rock from its surface expression. A case-study approach led to interviews with four students. Each attempted to work through a self-generated hierarchy of thickness problems. While working, the students explained why they took certain steps and what goals (or subgoals) they had established. Drawings made by these four students and the transcripts of the interviews comprise the data for the study. Two tentative conclusions have emerged: 1) a distinct set of "difficulty parameters" can help to generate thickness problems in a progression leading to good comprehension, 2) spatial and conceptual reasoning are very intimately connected -- each builds on the other. In other words, picturing the projection of a line onto another surface is enhanced (perhaps even dependent upon) the meaning of geological concepts to the student.

CRITICAL THINKING IN SCIENCE COURSES

Donald Pribor
University of Toledo
Toledo, Ohio

In one way or another, all education involves critical thinking. Whatever on's definition of critical thinking is, it builds upon or includes: 1) idealization of complex situations and 2) integration of diverse kinds of knowing.

Science courses tend to teach students not to think critically. Virtually all modern science textbooks are not only packed with many facts but many theories which incorporate several abstract concepts and a host of technical terms. Science courses "introduce" the student to most of these theories in a relatively short time -- at most one school year. Confronted with learning many scientific ideas in a short time, the student focuses on memorizing definitions of words rather than understanding ideas. That is, the student learns to think in terms of words rather than ideas. As a result, students repress rather than develop critical thinking.

One approach to solving this problem is to organize the course content around a single theme. The first 2/3 of the course would integrate other kinds of knowing related to the theme with scientific ideas.

The presentation will describe several courses which follow this format.

Style of Learning and Thinking in Adult Learners

Leon J. Zalewski
Mohammed Kishta
Governors State University
University Park, IL.

In the past three decades, neurological research into hemispheric contol of different thought and motor skills has produced interesting results related to learning and thinking. Learning and thinking styles are now being associated with left brain and right brain hemispheric dominance. According to the theory, some students have a dominating right hemisphere while others have a dominating left hemisphere for learning and thinking. Students in classrooms might prefer to think and learn with the verbal right brain and others might prefer to think visually or right brain. The purpose of this research was to determine the reliability of instruments used to assess dominance and to correlate the dominance with scores from Piaget-type puzzels.

Adult students enrolled in a science and mathematics course at an upper-division University were tested and retested using a Learning and Thinking Styles Instrument. Tests and retests were scheduled at least four weeks apart. In addition, two Piaget puzzles were used to determine if a relationship exists between dominance and cognitive thinking ability. A third "black box" puzzle was used to determine relationship of brain dominance to a spatial problem.

Correlation between test-retest scores on the Style of Learning and Thinking ranged from .85 to .91. Very low

correlations were discovered between volume, ratio and proportion and the "black box" spatial puzzles. This data suggests that while some students can be labeled right or left brain dominant thinkers and learners, no differences can be found among them when completing certain puzzles/tasks.

APPLICATIONS OF SCIENCE: COURSES SPANNING SCIENCE AND EDUCATION

John Penick
University of Iowa
Iowa City, Iowa

We all know that asking preservice teachers to learn about science does not insure them understanding the nature of science or being able to communicate it in the classroom. Our experience, the experience of many others throughout the world, and considerable research evidence indicates that preservice teachers need to be well grounded in both the societal and physical applications of science concepts. In such courses students use knowledge from science classes in identifying and resolving problems and issues in daily life.

At the University of Iowa, we offer a series of five courses in the societal and educational applications of various science disiciplines. In these courses, students are expected to use the science they have already learned as well as learn additional science. Sometimes this is used in more physical applications, such as technology, and other times it is in more societal applications as students delve into societal issues and try to determine what does the evidence from science have to offer.

This panel will present a series of ideas on the benefits of such courses at the University level, how to develop them, and teaching strategies used within them.

DEVELOPING CRITICAL THINKING SKILLS IN COLLEGE SCIENCE TEACHING

Robert Allen
Lakeland Community College
Mentor, Ohio

The inclusion of critical and analytical thinking skills as an integral part of science teaching is attracting greater attention among teachers. Such skills have, however, proven extremely difficult for students to develop. In this presentation some example teaching programs and appropriate research results will be described. The emphasis will be on ways teachers can make effective applications in their own couses. Example teaching material and exercises will be demonstrated and the difficulties students exhibit when attempting to practice and apply critical thinking skills will be discussed.

ORGANIZING A CENTER FOR SCIENCE EDUCATION TO MEET THE NEEDS OF RURAL SCIENCE TEACHERS

Emmett Wright
Kansas State University
Manhattan, Kansas

This session will be centered around the events and procedures that resulted in a campus-wide Center for Science Education at Kansas State University. The steps will be outlined that were used to develop and organize the center. Included will be a discussion of the findings of a Needs Sensing Conference and the Do's and Don't's of organizing an interdisciplinary effort to meet the needs of rural science teachers.

COMPREHENSIVE VIDEO TRAINING MATERIALS FOR ENHANCING TEACHER SKILLS

V. Daniel Ochs
University of Louisville
Louisville, Kentucky

Staff development has always been a critical issue among all educators. Participants will engage in a mechanism of staff development that uses videotapes to advance such diverse ideas as classroom and laboratory safety, creative problem solving, classroom management strategies, and establishing a living materials center. The workshop will include a sample viewing of the tapes and discussion. The videotapes have been professionally produced by teachers for teachers.

AN APPROACH TO HIGH SCHOOL AND COLLEGE CURRICULUM

Patricia Smith
Jenks High School and Tulsa Junior College
Tulsa, Oklahoma

I have developed and borrowed ideas that have worked well to initiate high interest that continues long after the student has completed the basic survey course. The required formulas can be easily taught and long remembered by the use of pneumonics and sensationalized learning keys. In this workshop, I will present some of the learning keys that students have taught me in both physical science and chemistry.

In addition, I will demonstrate activities which can be used as laboratory exercises or demonstrations. Among these are: a student horsepower activity, a gravitational acceleration activity, wood and coal destructive distillation, paper airplane construction and the dynamics of flight, and a freezing point depression lab: ice cream and sherbet made in a beaker with a pneumatic trough as the ice cream freezer.

An interdisciplinary program of in-service training for junior high and high school science teachers in Missouri

Dr. John Bauman, Dr. Betty Burchett, Richard Henderson, Rebecca Quinn, Gr. Gerald Summers
University of Missouri

An in-service training program for junior high and high school science teachers in central Missouri was developed through funds distributed to the State of Missouri from the Education for Economic Security Act. The heterogeneous background of teachers in small, rural school districts as well as their teaching enviornments suggested an integrated program of subject matter and teaching methods. The recent adoption of science core competencies by the Missouri Departments of Elementary and Secondary Education also influenced our interdisciplinary approach.

A team including university scienctists, faculty in the science education program, and master teachers from the Columbia (MO) public schools made visits to 3 out-of state sites. Integrated presentations from physics, chemistry, and biology were made on the topics of Energy and Matter, Water and Gases, and Light and Radiation. Each site visit included lectures, demonstrations, and laboratory experiences. Laboratory exercises emphasized observation and inquiry and were designed for easy transfer to school classrooms. Participants could select additional training in the science discipline of their choice in an intensive 3-week summer course. The interdisciplinary nature of the program was maintained through weekly seminars during the summer session.

SCHOOL DISTRICT COLLABORATIONS WITH HIGHER EDUCATION

Carol Wareing
California State University
Long Beach, California

In designing research and staff development collaboratives and in jointly seeking sources of funding, there are several steps to be assumed by school districts and colleges respectively and cooperatively.

Several partnerships and regional collaboratives with public and private colleges, community colleges, universities, professional organizations, and cultural institutes have been successfully planned and implemented in Massachusetts. Procedures and factors contributing to the varying degrees of satisfaction with such programs will be reviewed.

A few of the more noteworthy models for collaborative staff development in science which merit some attention are:

- Curriculum Leadership Teams
- Thematic Teaching
- Product-Process Partnerships
- Elementary-Secondary Mentorships
- Scientists-in-Residence Programs
- "Focus" Programs

Finally, specific needs common to many school districts which lend themselves well to higher education collaboratives will be identified and discussed.

WHAT WE LEARNED: TWO PROGRAMS LINKING COLLEGE AND PRE-COLLEGE SCIENCE AND MATHEMATICS

Charles Price
University of Southern Indiana

In 1983 and again in 1985, the Lilly Endowment, Inc. of Indianapolis, Indiana funded grants for the purpose of establishing and strengthening linkages between public schools and institutions of higher education. While programs were funded in many academic areas, the focus of the panel discussion will be on two programs in the areas of mathematics and science:

ADAPTING COMPUTER INSTRUCTION TO TEACHING SITUATIONS

Madison and Southwestern, Indiana Schools
Hanover College

The program included the development of skills in mathematics and science teachers to write computer programs for instructional purposes using an "educator friendly" authoring language and the investigation of commercially available courseware and computer-operated laboratory equipment for science.

MATHEMATICS AND SCIENCE TEACHING IMPROVEMENT PROGRAM

Metropolitan School District of Mt. Vernon, Indiana
University of Southern Indiana

The program was developed to enhance communication between public school teachers and their counterparts in the university, to encourage science and mathematics teachers to keep abreast of steadily increasing knowledge and high technology implications, and to articulate science and mathematics course content between

secondary schools and colleges.

The proposed panel will have five participants: Representatives from both public schools and colleges for each of the projects linkages above, and a program officer from Lilly Endowment.

Along with the content of the programs, the discussion will include the successes and failures, the expected and unexpected outcomes.

PROGRAM EVALUATION: SOME IDEAS AND EXAMPLES

John Penick
University of Iowa
Iowa City, Iowa

Taking advantage of some large scale research on characteristics of science teachers as identified by Iris Weiss and the National Assessment of Educational Progress attitudinal data we now have a base line against which to compare graduates of teacher education programs. The Iris Weiss data tells us much about science teachers in the United States while the NAEP data gives us a strong indication of the attitudes and beliefs of their students in regards to science, science teaching and science teachers.

Looking at these data it is relatively easy to decide to think how we would like our preservice teachers to prepare. With this ideal description, preservice teachers and teacher graduates from the University of Nebraska at Lincoln and the Universty of Iowa were asked to complete forms similar to those distributed by Iris Weiss and the NAEP. From these data representing about three thousand high school students and their teachers we now have a clear image of what our teachers are doing in classrooms and how this compares with the national sample taken at random. As a technique of program evaluation it is relatively unique, powerful, and useful.

We will present both the baseline data from Iris Weiss and the NAEP as well as the evaluation data from the two teacher

education programs. In addition, we will discuss the pros and cons of using ths particular data as a source of evaluation and suggest additional types of data that need to be collected.